



Structural organization of eukaryotic and prokaryotic cells.

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Structural organization of eukaryotic and prokaryotic cells.

- According to the cell theory, the cell is the basic unit of life. Based on the organization of their cellular structures, all living cells can be divided into two groups: prokaryotic and eukaryotic.

	Prokaryote	Eukaryote
Size and simplicity		
	Prokaryotic cells are generally much smaller and more simple than eukaryotes	Eukaryotic cells are generally much larger and more complex than eukaryotes
	Structurally more simple because of their small size	Structurally more Complex because of their large size and compartmentalization.
Surface-to-volume ratio		
	The prokaryotic cell have large surface-to-volume ratio, means that nutrients can easily and rapidly reach any part of the cells interior.	The eukaryotic cell have smaller surface-to-volume ratio, the limited surface area when compared to its volume means nutrients cannot rapidly diffuse to all interior parts of the cell. That is why eukaryotic cells require a variety of specialized internal organelles [i.e structurally complex (compartmentalized)] to carry out metabolism.
Nuclear Body		
	The prokaryotic nuclear body is not bounded by a nuclear membrane.	The eukaryotic nuclear body is bounded by a nuclear membrane having pores connecting it with the endoplasmic reticulum.
	The prokaryotic nuclear body usually contains one circular	The eukaryotic nuclear body contains one or more paired,

	chromosome composed of deoxyribonucleic acid (DNA) associated with histone- <u>like</u> proteins.	linear chromosomes composed of deoxyribonucleic acid (DNA) associated with histone proteins .
	The prokaryotic nuclear body have no nucleolus.	The eukaryotic nuclear body have nucleolus. Ribosomal RNA (rRNA) is transcribed and assembled in the nucleolus.
	The prokaryotic nuclear body is called nucleoid.	The eukaryotic nuclear body is called nucleus.
Cell Division		
	In prokaryotic cell the division is by binary fission. There is no mitosis.	In eukaryotic cell the nucleus divide by mitosis.
	In prokaryotic cell, cells are haploid. Meiosis is not needed.	In eukaryotes, haploid cells from the diploid cells are produced by meiosis.
Cytoplasmic Membrane- also known as a cell membrane or plasma membrane		
	In prokaryotic, plasma membrane is also a fluid phospholipid bilayer but usually lack sterols. Bacteria usually have sterol like molecules known as hopanoids.	In eukaryotes, plasma membrane is a fluid phospholipid bilayer containing sterols.
	In prokaryotes the membrane is incapable of endocytosis and exocytosis.	In eukaryotes the membrane is capable of endocytosis (phagocytosis and pinocytosis) and exocytosis .
Cytoplasmic Structures		
	In prokaryotes the ribosomes are composed of a 50S and a 30S subunit that come together during protein synthesis to form a 70S ribosome .	In eukaryotes the ribosomes are composed of a 60S and a 40S subunit that come together during protein synthesis to form an 80S

		ribosome along with 70S ribosomes.
	In prokaryotes the Internal membrane-bound organelles such as mitochondria, endoplasmic reticulum, Golgi apparatus, vacuoles, and lysosomes are absent.	In eukaryotes the Internal membrane-bound organelles such as mitochondria , endoplasmic reticulum , Golgi apparatus , vacuoles, and lysosomes are present.
	In prokaryotes there are no chloroplasts. Photosynthesis usually takes place in infoldings or extensions derived from the cytoplasmic membrane.	In eukaryotes the Chloroplasts serve as organelles for photosynthesis.
	In prokaryotes there is no mitosis and no mitotic spindle.	In eukaryotes a mitotic spindle involved in mitosis is present during cell division.
	In prokaryotes the various structural filaments in the cytoplasm collectively make up the prokaryotic cytoskeleton . Cytoskeletal filaments play essential roles in determining the shape of a bacterium (coccus, bacillus, or spiral) and are also critical in the process of cell division by binary fission and in determining bacterial polarity.	In eukaryotes a cytoskeleton is present. It contains microtubules, actin microfilaments, and intermediate filaments. These collectively play a role in giving shape to cells, allowing for cell movement, movement of organelles within the cell and endocytosis, and cell division.
Respiratory Enzymes and Electron Transport Chains		
	In prokaryotes the electron transport system is located in the cytoplasmic membrane	In eukaryotes the electron transport system is located in the inner membrane of the mitochondria and in the lumen of chloroplast.
Cell Wall		
	In prokaryotes With few exceptions, members of the domain Bacteria have cell	In eukaryotes, the Plant cells, algae, and fungi have cell walls, usually composed of

	walls composed of peptidoglycan.	cellulose or chitin. Eukaryotic cell walls are never composed of peptidoglycan.
	In prokaryotes the Members of the domain Archae have cell walls composed of protein, a complex carbohydrate, or unique molecules resembling but not the same as peptidoglycan.	In eukaryotes the Animal cells and protozoans lack cell walls.
Locomotory Organelles		
	In many prokaryotes, they have flagella, each composed of a single, rotating fibril and usually not surrounded by a membrane. There are no cilia.	In eukaryotes the cells may have flagella or cilia. Flagella and cilia are organelles involved in locomotion and in eukaryotic cells consist of a distinct arrangement of sliding microtubules surrounded by a membrane. The microtubule arrangement is referred to as a 2X 9+2 arrangement.
Representative Organisms		
	Prokaryotic cell: The domain Bacteria and the domain Archae.	Eukaryotic cell: The domain Eukarya: animals, plants, algae, protozoans, and fungi (yeasts, molds, mushrooms).



Since viruses are acellular (i.e- viruses are not cells and have no cellular organelles), cannot grow and divide, and carry out no independent metabolism - they are considered neither prokaryotic nor eukaryotic.

Must remember Key point : Structural organization of eukaryotic and prokaryotic cells

Prokaryotic cells:

- Prokaryotic cells are small, simple cells that lack a membrane-bound nucleus and other complex organelles.
- They have a single circular chromosome located in the nucleoid region, which is not enclosed by a membrane.
- They also have ribosomes, which are responsible for protein synthesis, and a cell membrane that regulates the movement of substances in and out of the cell.
- Some prokaryotic cells have flagella, which are used for movement, and pili, which are used for attachment.

Eukaryotic cells:

- Eukaryotic cells are larger, more complex cells that have a membrane-bound nucleus and other organelles.
- They have multiple linear chromosomes located in the nucleus, which is enclosed by a double membrane.
- They also have other organelles such as mitochondria, which produce energy, and endoplasmic reticulum, which is involved in protein synthesis and lipid metabolism.
- Eukaryotic cells also have a cytoskeleton, which provides structural support and helps with cell movement and division.